

WHAT IS CLAIMED IS:

1. A process of preparing a nanocomposite comprised of an elastomer and at least partially exfoliated platelets from a water-swellable clay which comprises blending:

5 (A) an aqueous pre-formed elastomer latex comprised of elastomer particles with cations on the surface thereof prepared by aqueous free radical induced polymerization of monomers in the presence of a free radical generating polymerization initiator and surfactant;

wherein said monomers are comprised of:

10 (1) styrene and 1,3-butadiene monomers which contain from about 0.1 to about 40 weight percent styrene monomer,

(2) styrene and isoprene monomers which contain from about 0.1 to about 40 weight percent styrene monomer,

(3) isoprene monomer,

15 (4) 1,3-butadiene monomer,

(5) isoprene and 1,3-butadiene monomers,

(6) 1,3-butadiene and acrylonitrile monomers which contain from about 5 to about 45 weight percent acrylonitrile monomer; or

20 (7) isoprene and acrylonitrile monomers which contain from about 5 to about 45 weight percent acrylonitrile monomer

wherein said free radical generating polymerization initiator is selected from:

(1) a cationic aqueous polymerization initiator, or

(2) an anionic aqueous polymerization initiator, or

(3) neutral aqueous polymerization initiator, or

25 (4) a redox free radical initiator system;

wherein said elastomeric polymer particles are stabilized in said latex by a surfactant selected from:

(1) non free-radically polymerizable cationic surfactant, and/or

(2) free-radically polymerizable cationic surfactant;

30 (B) an aqueous mixture of water and a multilayered water-swellable clay which contains cationically exchangeable ions in its galleries between said layers, exclusive of an intercalant for said clay, wherein said water-swellable clay is comprised

of a plurality of stacked platelets with water-swollen galleries between said platelets, wherein said galleries contain cationic ion exchangeable ions therein.

2. The process of claim 1 wherein said monomer(s) is 1,3-butadiene or
5 combination of styrene and 1,3-butadiene monomers.

3. The process of claim 1 which comprises a substantially simultaneous combination of:

(A) ion transfer mechanism of the cationically exchangeable ions (e.g. sodium ions) in the galleries between the stacked platelets of the water-swellable clay and the cationic surfactant,

(B) a destabilization of the elastomer latex and thereby a destabilization of the elastomer particles,

(C) the migration of the elastomer particles into the galleries between the platelets of the swollen, intercalated clay to aid in forming polymer-bound platelets

(D) and a substantial exfoliation of the polymer-bound platelets within the elastomer host and

(E) coagulation of the elastomer particles from the destabilized elastomer latex.

20 4. The process of claim 1 wherein said monomers for the said pre-formed elastomer also contain:

(A) from about 0.1 to about 20 weight percent, based upon the total monomers, of an additional copolymerizable monomer, selected from at least one of alkyl acrylates, alkyl methacrylates, acrylamide, methacrylamide, N-alkylacrylamide, N-alkyl methacrylamide, N,N-dialkyl acrylamide and N,N-dialkyl methacrylamide, wherein said alkyl groups contain from one through four carbon atoms; alpha methylstyrene, 2-vinyl pyridine and/or 4-vinyl pyridine, and/or;

(B) from about 0.1 to about 20 weight percent, based on the total monomers, of an elastomer functionalizing monomer selected from hydroxypropyl acrylate, hydroxypropyl methacrylate (HPMA), 2-(dimethylamino) ethyl methacrylate, 4-anilinophenyl methacrylamide, 2-hydroxyethyl acrylate and 2-hydroxyethyl methacrylate.

5. The process of claim 1 wherein said free radical generating polymerization initiator is

(A) a cationic aqueous polymerization initiator selected from at least one of 2,2'azobis(2-methylpropionamidine) dihydrochloride and 2,2'azobis(N, N'

5 dimethyleneisobutyramidine) dihydrochloride,

(B) an anionic aqueous polymerization initiator selected from at least one of potassium peroxydisulfate and ammonium peroxydisulfate

(C) a neutral free radical aqueous polymerization initiator selected from at least one of benzoyl peroxide and azobisisobutyronitrile, or

10 (D) a redox polymerization system.

6. The process of claim 1 wherein said surfactant(s) is (are) comprised of said non-free radically polymerizable cationic surfactant and/or free radically polymerizable cationic surfactant and from about 1 to about 20 weight percent non-ionic surfactant (based upon the total of said surfactants).

7. The process of claim 1 wherein said surfactant is:

(A) a free radically polymerizable cationic surfactant selected from at least one of alkyl bromide (or chloride) quaternary salts of 2-dimethylaminoethyl

20 methacrylate, polymerizable acrylate and methacrylate mono and diquaternary ammonium salts, alkyl bromide (or chloride) quaternary salts of meta or para

vinylbenzene dimethylamine, alkyl bromide (or chloride) quaternary salts of N,N dimethylallylamine, alkyl bromide (or chloride) quaternary salts of ortho or para vinyl pyridine, alkyl bromide (or chloride) salt of vinyl imidazole, N-((11-methacryloyloxy)

25 undecyl)-4-methyl pyridinium bromide, 5-(para vinyl phenyl)

pentyltrimethylammonium bromide, 11-methacryloylolyundecyltrimethylammonium bromide, 11-acryloylundecyltrimethylammonium bromide, vinylbenzylamine hydrochloride, and aminoethylmethacrylate hydrochloride, or

(B) a non free-radically polymerizable cationic surfactant as

30 cetyltrimethylammonium bromide (CTAB) or cetyltrimethylammonium chloride.

8. The process of claim 1 wherein said cation-containing chain transfer agent is 2-aminophenyldisulfide dihydrochloride.

17. A rubber composition which comprises, based upon parts by weight per 100 parts by weight elastomer (phr):

(A) about 5 to about 150 phr of the nanocomposite of claim 13,

5 (B) from zero to about 95 phr of at least one additional diene-based elastomer, so long as the total of the elastomer contained in said nanocomposite and said additional diene-based elastomer is 100 parts by weight,

(C) from zero to about 80 phr of at least one additional reinforcing particulate filler selected from carbon black, precipitated silica aggregates, silica-containing carbon black which contains domains of silica on its surface, and mixtures thereof, and,

10 optionally

(D) a coupling agent which contains a moiety reactive with hydroxyl groups (e.g. silanol groups) contained on the peripheral edges of the surface of the platelets of said exfoliated platelets and reactive with hydroxyl groups (e.g. silanol groups) contained on the surface of said precipitated silica and said silica-containing carbon black, and
15 another moiety which is interactive with said diene-based elastomer(s) of the elastomer(s) of said nanocomposite and at least one of said additional elastomers if said additional elastomer is used.

18. The rubber composition of claim 17 wherein said additional conjugated diene-based elastomers are selected from at least one of cis 1,4-polyisoprene (natural and synthetic), cis 1,4-polybutadiene, styrene/butadiene copolymers (aqueous emulsion polymerization prepared and organic solvent solution polymerization prepared), medium vinyl polybutadiene having a vinyl 1,2-content in a range of about 15 to about 90 percent, isoprene/butadiene copolymers, styrene/ isoprene/butadiene terpolymers. Tin
20 coupled elastomers may also be used, such as, for example, tin coupled organic solution polymerization prepared styrene/butadiene co-polymers, isoprene/butadiene copolymers, styrene/isoprene copolymers, polybutadiene and styrene/isoprene/butadiene terpolymers.
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19. An article of manufacture having at least one component comprised of

30 (A) said nanocomposite of claim 13, or

(B) a blend of said nanocomposite of claim 13 and at least one additional elastomer and/or reinforcing filler.

20. A tire having at least one component comprised of:

(A) said nanocomposite of claim 13, or

(B) a blend of said nanocomposite of claim 13 and at least one additional elastomer and/or reinforcing filler.